Domiciliary treatment of femoral shaft fracture in children

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Summary

A total of 20 children presenting in Accident and Emergency (A&E) Department of University College Hospital, Ibadan, Nigeria with femoral shaft fracture treated with straight leg fixed traction in a domiciliary setting is presented. The male:female ratio is 3.2 with fall accounting for 65% of the cases. There was satisfactory correction of overriding and angular deformity following the application of the fixed traction in all the patients. There was good Callus formation at six weeks with no vascular, neurological or soft tissue complication.

Keywords: ***Domicilliary, Femoral fracture, Children.***

Résumé

Il s'agit d'un nombre total de 20 enfants qui ont été enregistrés dans le service d'Accident et d'Urgence (A&E) du Collège Hospitalo-Universitaire, Ibadan, Nigeria atteints de la fracture shaft fémorale avec la jambe droite traction fixée dans une ambiance domiciliaire. Le rapport mâle-femme est 3 pour 2 et la baisse est recensée à 65% des cas. La correction de la difformité principale et osseuse a connu un succès suite à l'administration d'une traction fixée chez tous les patients. La formation de cal osseux dans six semaines était bonne sans des complications neurologique vasculaires ou du tissu doux.

Introduction

Shaft fractures of the femur are relatively frequant in children and must be considered serious injuries because of the blood loss and potential shock accompanying the primary trauma. These fractures generally result from violent injuries, especially automobile accidents, and great care must be taken to rule out associated injuries as well as neurologic and vascular complications[1].

There are various conservative methods of management advocated for femoral shaft fractures in children. They are traction methods such as Bryant and Russel traction and use of Spica cast either as immediate spica immobilisation or cast immobilisation following 3 to 4 weeks after traction[2,3]. In the United Kingdom, the use of a Thomas;s Splint with skin traction is common, though this has the disadvantage of requiring in-patient care4, while domiciliary gallows for femoral shaft fractures in young children was advocated by Holmes *et al*[5].

In our hospital, the demand of the paediatrics-orthopaedic section for beds is generally greater that the available number of beds, a situation which has been reported in other hospitals[2].

The classical experience in this hospital has shown that children with femoral shaft fractures not admitted for lack of paediatric hospital bed spare return weeks later with significant deformity and major complications. Another problem is that the Plaster of Paris material often available is of poor quality probably due to poor storage system, resulting in cast that is weak with poor control of fracture and causing overriding with angular deformity. An alternative is a procedure that would require an adequate outpatient care.

The study was carried out to see the feasibility,safety and advantages of Thomas's splint in straight leg fixed traction in femoral shaft fracture in children on an outpatient basis after initial 48 hours of admission in Accident and Emergency Department (A&E).

Materials and methods

All consecutive children between the ages of 3 years and 9 years with isolated single femoral shaft fracture presenting in Accident and Emergency (A&E) Department of the University College Hospital (UCH), Ibadan, Nigeria between January, 2001 and August, 2001 were included in the study. The fractures are all closed fractures.

Exclusion criteria were children with other associated injuries, children whose parents were not available to be instructed on the care of the splint, children who were residing outside the city.

The materials used were Thomas;s splint, Paediatric skin traction kit, two wooden Spatula, 1 metre square cotton drape, cotton wool for leg support on the cotton drape, four safety pins and two 6-inch crepe bandage, used to wrap the limb and the Thomas Splint exposing the foot and toes.

Thomas's Splint was applied to the affected limb to effect straight leg fixed traction after intramuscular injection of pentazocine 1mg/kg body weight to reduce pain. The child was admitted in the A&E ward for 48 hours, toes and foot are examined for colour, movement and warmth. The groin and buttocks were also examined for redness and abraision. It was possible to adjust the tension in the traction using the incorporated two wooden spatula. A radiograph of the femur was done at 48 hours just before discharge from the A&E and the children were to be seen at the next visit in SOP only if the x-rays were judged satisfactory.

The parents were then instructed on the Nursing Care of the children and the splint, and instructed to put a pillow under the end of the traction to elevate the Thomas's Splint. They were trained to check the toes for colour and warmth. They were also advised to bring the children to the hospital if the splint becomes loose or the child experienced any discomfort or the toes became cold, changed colour or painful to touch. The children were to visit the clinic at end of 1 week, 2 weeks and 8 weeks after discharge from A&E. During each clinic visit, the Senior Registrar or the Consultant in-charge of the case examined the splint for looseness, the toes for colour, temperature and movement while the groin was inspected for abrasions or ulceration.

A radiograph was also done at the end of 1 week and 6 weeks after discharge from A&E. The traction is removed at 8th week. Children that were able to use crutches were mobilised using crutches for 2-3 weeks. Satisfactory radiograph was defined as less than 2cm of overriding, less than 30° of anterior angulation. Any angulation in excess of this, lateral or posterior angulation was corrected by adjusting the traction and the cotton wool padding.

**Correspondence*

Table 1 Distribution of patients' characteristics on x-ray by sex

Characteristics	Sex Male Freq.	%	Female Freq.	%	Total		X^2	P value
Side fracture								
Left	8	66.7	4	50.0	12	60.0	0.08	0.78
Right	4	33.3	4	50.0	8	40.0		
Cause of fracture								
RTA	4	33.3	3	37.5	7	35.0		
Fall	8	66.7	5	62.5	13	65.0	0.08	0.77
Level of fracture								
Middle third	7	58.3	7	87.5	14	70.0		
Distal third	1	8.3	1	12.5	2	10.0		
Upper third	3	25.0	0	0.0	3	15.0	3.33	0.34
Subtrochanteric	1	8.3	0	0.0	1	5.0		
Type of fracture								
Oblique	4	33.3	1	12.5	5	25.0		
Transverse	7	58.3	1	12.5	8	40.0		
Spiral	0	0.0	6	75.0	6	30.0	13.02	0.005
Communitted	1	8.3	0	0.0	1	5.0		
Angulation (AP)								
0 – 10°	7	58.3	1	12.5	8	40.0	2.51	0.07
15 – 30°	5	41.7	7	87.5	12	60.0		
Angulation (Lateral)								
0 – 10o	1	8.3	0	0.0	1	5.0		
15 – 30°	1	8.3	1	12.5	2	10.0	0.01	1.00
Angulation (Medal)								
0 – 10°	4	33.3	3	37.5	7	35.0	0.01	1.00
15 – 30°	6	50.0	4	50.0	10	50.0		

Statistical analysis

The statistical package Epi-Info version 6.02 was used for data entry, editing and cleaning.

The chi-square test was used to examine the statistical significance between any two categorical variables and student's t-test was used to compare the mean values of numerical continuous variables between two groups.

All statistical tests were two tailed carried out at 5% level of significant.

Result

Demographic characteristics

The age-sex distribution of the 20 patients seen over a period of eight months show that a high majority of the patients were males (60.0%) with a male/female ratio of 3:2. The majority of the patients were children of age 5-9 years (55.0%) while the remaining 45.0% were age 0-4 years. The proportion of male children between age 0-4 years and 5-9 years were equal while female children were more in the age group 5-9 years (62.5%). However, there was no statistically significant difference in the age distribution of male and female children (P>0.05). The mean age of the children was 4.90 ± 2.08 years with female children having a higher mean age of 5.63 ± 1.85 years compared to male 4.47 ± 2.15, but the difference in the mean age was not statistically significant (P>0.05).

Six children with femoral shaft fracture were excluded from the study because of associated injury. Two children had associated head injury, three children had associated fracture in other bones (two children had Tibia fracture, one child had forearm fracture) while one child had associated abdominal trauma. The in-patient care excluded them from the study.

Characteristics of fracture on X-ray

The distribution of patients' characteristics on x-ray, side of fracture and causes of fracture by sex was shown in Table 1. Twelve patients (60.0%) had their fractures on the left side, the majority of the male patients had their fracture on the left side (66.7%) while equal proportion of female patients (50.0%) each had their fracture on either left or right side. There was no statistically significant sex difference in the distribution of side fracture (P>0.05).

The major cause of fracture was fall (65.0%), similar in both sexes with 66.7% of male and 62.5% of female respectively. Other patients (35.0% reported road traffic accident (RTA). There was no statistically significant difference in the distribution of cause of fracture in both sexes (P>0.05). The fall were mostly home or school accidents while the road traffic accident were all pedestrial vehicular injury.

The distribution of the patients by level of fracture is shown in the third panel of the Table 1. The majority of the patients (70.0%) had middle third fracture, this was followed by 3 (15.0%) patients with upper third fracture, 2 patients (10.0%) had distal third and only 1 patient (5.0%) had subtrochanteric fracture. Transverse fracture was the most common type of the fracture (40.0%), 6(30%) had spiral fracture while oblique and communitted fracture occurred in 5 patients (25.0%) and one patient (5.0%) respectively. The majority of the males 7(58.3%) had a transverse fracture, while 6 (75%) of females' fracture were of the spiral type. There was a statistically significant association between sex and type of fracture (P<0.05).

The anterior angulation of most of the patients was between 150 – 30° (60.0%) and the remaining proportion had between 0-10° anterior angulation. Most of the male children (58.3%) had 0-10° anterior angulation while the majority of their

Table 2 Distribution of patients' characteristics on x-ray by side of fracture

Characteristics	Side of fracture							
	Left		Right		Total			
	Freq.	%	Freq	%	Fre.	%	X^2	P value
Level of fracture								
Middle third	6	50.0	8	100.0	14	70.0		
Distal third	2	16.7	0	0.0	2	10.0	5.71	0.13
Upper third	3	25.0	0	0.0	3	15.0		
Subtrochanteric	1	8.3	0	0.0	1	5.0		
Type of fracture								
Oblique	4	33.3	1	12.5	5	25.0		
Transverse	6	50.0	2	25.0	8	40.0	4.86	0.18
Spiral	2	16.7	4	50.0	6	30.0		
Communitted	0	0.0	1	12.5	1	5.0		
Angulation (AP)								
0 – 10°	5	41.7	3	37.5	8	40.0	0.08	0.78
15 – 30°	7	58.3	5	62.5	12	60.0		
Angulation (Lateral)								
0 – 10°	1	8.3	0	0.0	1	5.0	0.00	1.00
15 – 30°	1	8.3	1	12.5	2	10.0		
Angulation (Medal)								
0 – 10o	3	25.0	4	50.0	7	35.0		
15 – 30°	7	58.3	3	37.5	10	50.0	0.38	0.54

Table 3 Distribution of patients' characteristics at various time following Thomas's Splints

Characteristics	At time of Thomas's Splint		1 week after		2 weeks after	
Pain relieve						
Yes	19	95.0	20	100.0	20	100.0
No	1	5.0	0	0.0	0	0.0
Toes						
Pink & warm	20	100.0	20	100.0	20	100.0
Pale & Cold	0	0.0	0	0.0	0	0.0
Angulation (Ap)						
0 – 10°	8	40.0	11	55.0	10	50.0
15 – 30°	12	60.0	9	45.0	10	50.0
Angulation (Lateral)						
0–10°	1	5.0	3	15.0	3	15.0
15 – 30°	2	10.0	0	0.0	0	0.0
Angulation (Medal)						
0 – 10°	7	35.0	17	85.0	17	85.0
15 – 30°	10	50.0	0	0.0	0	0.0

female counterparts (87.5%) had 15 – 30° anterior angulation. The majority of the patients had 15 – 30° medial angulation (50.0%), followed by those with 0-10° medal angulation (35.0%), 10.0% of the patients had 15 - 30° lateral angulation and the remaining proportion of the patients had 0–10° lateral angulation. This pattern was similar in the two sexes.

Characteristics of fracture following Thomas's Splint Application and Weeks of Therapy

Table 2 shows the distribution of the patients' fracture characteristics on application of Thomas's Splint therapy at each weekly follow-up time. The majority of the patients (95.0%) showed evidence of relief in pain immediately after Thomas Splint and by the end of first week of Thomas 's Splint and until the end of the management period, no one reported any pain episode. Also, all the patients had pink and warm toes following Thomas's Splint and this was reported throughout the period of management.

Following Thomas's Splint application, there was reduction in anterior angulation, medial angulation and lateral angulation to acceptable level. This was maintained throughout the study.

The degree of overriding (cm) at various times after Thomas's Splint showed its mean overriding on x-ray was 2.23 (SD=1.38) reduced to a mean of 1.31 (S.D=0.65) following Thomas's Splint application. The overriding further reduced to 1.13 (SD=0.64) at six weeks of Thomas's Splint. The reduction

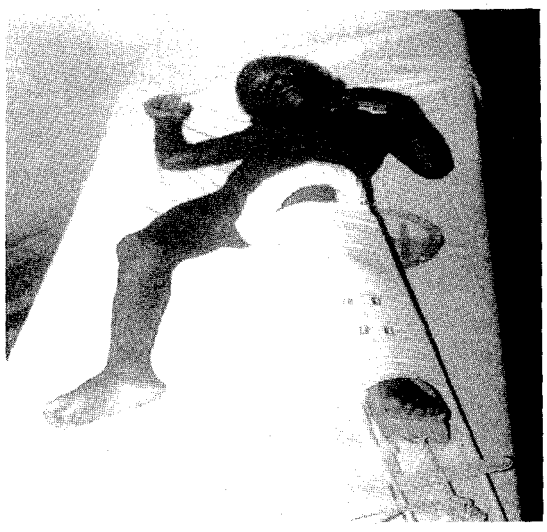

Fig. 1 ***The picture shows a child with Thomas' Splint in situ***

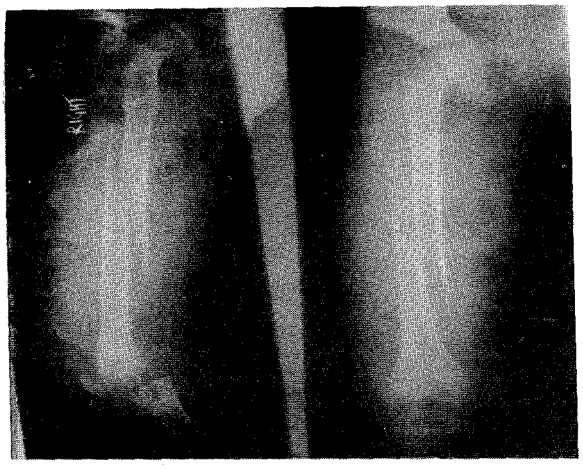

Fig. 2 ***The radiograph shows the fractured femur before the application of Thomas' Splint.***

in the mean overriding was statistically significant immediately after the Thomas Splint was applied (P<0.05).

Table 3 shows the distribution of patients' characteristics after Thomas Splint by side of fracture. The majority of the

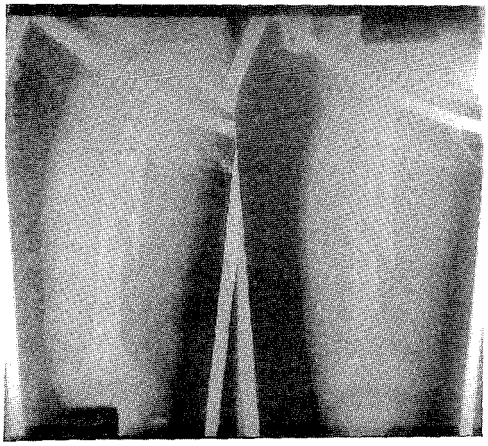

Fig. 3 ***The radiograph shows the fracture with the Splint in situ. Note the improvement in the overriding of the fracture.***

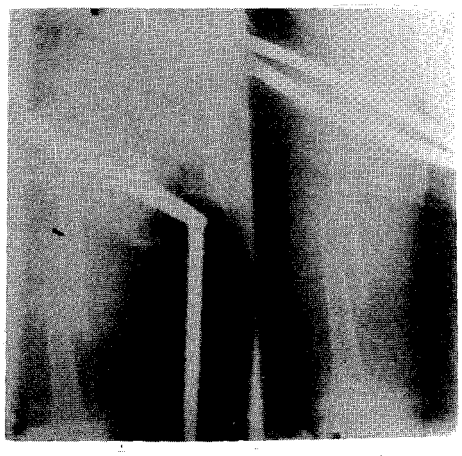

Fig. 4 ***Shows evidence of callus formation at fracture site with maintenance of good position of the fracture.***

patients 19(95.0%) had good callous formation. This was true for fracture on both sides of the body. The tension in the traction was maintained in 85% of patient while the remaining has the tension readjusted due to loosening.

Only 7(36.8%) of patients were mobilised with crutches, 25.0% of those with right fracture and 45.5% with left side but this was not statistically significant (P>0.05). A high proportion of the patients (90.0%) had no abrasion or no pressure effect on their groin. All the patients had their splints removed after eight weeks of application.

Complication

No serious adverse event occurred as a result of the treatment except for one patient that was withdrawn from the study. This patient had high subtrochanteric fracture on x-ray. The patient did not benefit from the study as there was no improvement on his anterior and medial angulation one week after Thomas's Splint was applied, his deformity was worsened and hence discontinued from the study.

Discussion

In the management of femur shaft fractures in children, certain principles have been advocated. They include using the simplest form of satisfactory treatment, maintenance of the initial treatment where possible and restoration of alignment over anatomic reduction. It is important to realise that the more growth remaining in the fractured femur, the more likelihood there is of restoration of normal osseus architecture as the bone remodels. However, the hope that all deformities in children would correct themselves spontaneously was no excuse for leaving any deformity that could be corrected by simpler means and manipulation. Shortening of less than 2cm, anterior or medial angulation of less than 15°, and absence of rotation are the major goals to achieve in non-operative treatment[6]. The use of straight leg fixed traction in a domiciliary set up complies with the above principles.

The study revealed that majority of the fracture occurred in the middle third of the shaft and fall accounting for majority of the injuries. There is male/female ratio of 3:2. The above findings are similar to reports in other studies. This study was discontinued in one patient with high subtrochanteric fracture of femur at 1 week when x-ray showed marked displacement of the fracture. This patient was admitted and skeletal traction applied with good result after 6 weeks in traction. We do not at present recommend the use of these methods of treatment for high subtrochanteric femoral fractures in children. This type of fracture are further displaced by the ring of Thomas's Splint.

There were no vascular, neurological or soft tissue complications in this study. This could be due to careful application of the splint and education of the parents by the medical staff as well as access to the orthopaedics team by the parents in case of any difficulty.

There is also correction of the deformity (angular and longitudinal) to within acceptable limits which was consistent with the observation by Holmes *et al*[5] in their study on domiciliary gallow traction for femoral shaft fractures in young children.

There was good callus formation at six weeks with no case of non union, and this is in agreement with widely held view that femoral shaft fracture heals rapidly in children[5,6].

The main advantage of the method of treatment reported in this study is its simplicity, those methods that employ skeletal traction or internal fixation present small but significant risks of infective complication, and require general anaesthesis

with hospital admission[5]. The avoidance of prolonged separation of children from their parents was also an important benefit coupled with the facts that these children were being treated by qualified orthopaedics surgeons otherwise the children could have been treated by local bone setters with disastrous results for lack of paediatric orthopaedic hospital beds. The total cost for full treatment is fifteen U.S dollars ($15.00) while the cost of hip spica is between thirty and fifty U.S dollars ($30.00-$50.00) depending on the size of the children.

Conclusion

A satisfactory outcome was observed from the treatment of 20 children with fracture femur by fixed traction using Thomas's Splint in a domiciliary setting. There was good healing with no deformity (angular and longitudinal). No soft tissue complication.

We submit that this treatment is safe, affordable and with obvious advantage. However, at present, it should be carried out in centers with orthopaedic surgeon in attendance.

References

1. Hedlund R, Lindgren V: The incidence of femoral shaft fractures in children and adolescent. J. Pediatr Orthop 1986; 6: 47.

2. Allen BL, Kan AP, Emery RE. Displaced fractures of the femoral diaphysis in children. Definitive treatment in a double spica test. J. Trauma 1977; 17: 8.

3. Irani R, Nicholson J, Chung S. Long term results in treatment of femoral shaft fractures in young children by immediate spica immobilisation. J Bone Joint Surg 1976; 58A: 945.

4. Burton V, Fordyce A. Immobilisation of femoral shaft fractures in children aged 2-10 years. Injury 1973; 4: 47.

5. Holmes SJ, Sedwick DM, Scobie, WG: Domiciliary gallows traction for femoral shaft fractures in young children: Feasibility, safety and advantages. J. Bone Joint Surg 1983; 65B: 288.

6. Skeletal Injury in the child W.B. Saunders Company 1990 second edition pp 710.